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# Healthcare Analytics in Navy Medicine

*Perspectives and Methods for Decision-Making*

## FOCUS ON POPULATIONS

Representations of Populations in Military Healthcare Planning

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Populations are represented in many different constructs in healthcare system planning and analysis. Population counts can be used as a convenient proxy for something else, such as a representation of demand for services, or they can be used for something more exacting, such as a component factor of a prescribed capitation financing formulation. An appreciation of the diversity of the many possible representations of populations will serve planners well as they contribute to the continuing evolution and realignment of the many considerations and practices that go into the evaluation and management of Navy Medicine as a healthcare delivery system. Several of these representations of populations are described in this article.

**Eligible Beneficiaries**

Eligibility for medical services provided by the Military Health System (MHS) is established for an individual by being registered in the Defense Enrollment Eligibility Reporting System (DEERS) and being flagged as being eligible for specific benefits. The most basic of questions in military healthcare planning is "What population do we provide services for?" Fundamentally, that is all eligible beneficiaries, but a representation that reorganizes all eligible beneficiaries in some fashion with specific MTFs or branches of service is essential for effective planning purposes.

The quantification of eligible beneficiaries is relatively straightforward when performed for the MHS as a whole. However, its *practical* usage is quite different when used from the perspective of a subset of the MHS, such as an individual branch of service, facility, or caregiver. This has been historically addressed by use of geographic proximity constructs, and beginning in the 1990's, with enrollment inventories. However, the use of medical services by eligible beneficiaries often crosses many population constructs, especially in locations where there are multiple MTFs and military bases. For example, quantifying the utilization of orthopedic services by "Navy" beneficiaries might require some combination of an individual's sponsoring military service, branch of service with which the enrollment site is affiliated, and the geographic proximity of the individual to a specific MTF.

**Enrollee Populations**

When DEERS was first established, there was a push to get individuals "enrolled" in DEERS. What was meant by that was not enrollment to an MTF in the current or traditional sense, but to be *registered* in DEERs. This was mostly relevant with respect to dependents who were "flying under the radar". When real enrollment provisions were enabled in DEERS, there were some unintended consequences with the language. Unfortunately, the previous desire to be comprehensive with DEERS registration extended itself into aggressive MTF enrollment efforts with the consequence that many sites were effectively over-enrolled beyond their capacity to provide care and services.

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When an eligible beneficiary enrolls to an MTF, the branch of service with which the enrollment site is affiliated, the facility, and the designated caregivers are primarily responsible for the care provided to that beneficiary. Having a firm understanding of enrollment inventories is particularly important as MTFs and caregivers attempt to more efficiently manage the use, quality, and costs of the care provided to their enrolled populations. Though active participation in the management of healthcare needs are inherent with respect to an enrolled population, shifts in focus toward enrollment-based concepts can unfortunately diminish a sense of interest in the remainder of the beneficiary population for which we nevertheless retain implicit responsibilities.

It should also be noted that longitudinal trends in enrollment counts can be tricky to clearly represent. The early years were plagued by incomplete data and quality problems in DEERS, whereas later years see new enrollment categories created which draw down beneficiaries from other categories of enrollment. Meaningful trend analysis can require considerable understanding of the provisions for each enrollment category and a history of their implementation.

**Geographic Proximity**

Demographic changes (e.g., an aging population that results in more retired beneficiaries), policy changes (e.g., the implementation of the TRICARE Young Adult Program), and operational needs (e.g., the activation of Reserve and National Guard members) can significantly change beneficiary counts within the MHS and with respect to specific MTFs. The geographic proximity of eligible beneficiaries to an MTF will influence both the quantity and types of services provided by an MTF. Moreover, increases in the number of eligible beneficiaries living outside of MTF service areas will result in an increasing reliance on civilian providers and networks. For these reasons, effective health care planning also requires an understanding and consideration of various geographic proximity models such as Catchment Area, non-Catchment Area, PRISM Area, and MTF Service Area. Many of these models are defined in greater detail in the “Data and Information Systems” section of this issue of *Healthcare Analytics in Navy Medicine*.

Analysts have access to sufficient data in the M2 and MDR data repositories that allow them to implement relatively complex combinations of business rules to reorganize population counts based on geographic proximity concepts in conjunction with sponsor service, beneficiary category, MTF branch of service affiliation, and many additional attributes. For best results, it is advisable for the requestor of these types of population counts to advise the analyst of the business context in which the numbers will be used. It is equally important for the analyst to inquire further if the business context is unclear or not presented at all.

**Access and Drive Times**

Adequate access to care is a chief concern for healthcare system planners. One means of measuring access is with estimated drive times to the point of care. This can be thought of as a variation on the geographic proximity models discussed earlier, and it is a relatively recent line of development in the MHS. Access and drive time standards can determine who is allowed to enroll to an MTF and which non-enrolled beneficiaries a MTF might target for better care management.

**Capitation and Risk-Adjusted Populations**

Under a capitation payment system, facilities are paid a set amount for each person assigned to a health care provider per period of time, whether or not that person seeks care. The MHS capitation model proposed in the 1990’s was based on counts of eligibles, but its development was suspended years ago. Capitation is currently being reintroduced in the MHS as an enrollee count model associated with Medical Home primary care. Because healthier populations require fewer resources than sicker populations, it is important that any capitation payment system also account for differences in health status among various populations using risk-adjustment methods. Risk-adjustment can be used for the purpose of measuring and/or predicting the health care expenditures of individuals or groups, and applied specifically as part of a payment or resourcing system. Although there is no provision for case mix consideration in the current Medical Home capitation payment model, individual commands may be expected to adjust their Medical Home empanelments based on patient demographics, such as age and sex, and known health histories.

In summary, successful military healthcare planning requires an understanding of multiple population concepts and knowledge of reliable methods to identify and characterize these populations. The content of this article introduces a few of the core population concepts used mostly at a macro level in the MHS. Future issues of this publication will extend these concepts to a discussion of population health and clinical management.

## SKILLS AND METHODS

### *– UNDERSTANDING POPULATION PROJECTIONS*

Forecasting healthcare utilization generally requires estimating both the future demand and supply of health services. Predicting future demand involves projecting the populations that will utilize these services. This article discusses the components of population projections – both eligible and enrolled populations – and why these components are important to accurate healthcare planning.

Healthcare planning for the future requires estimating the demand for medical services. Forecasting healthcare services necessitates the evaluation of past determinants (or causes) of healthcare needs from the population and modeling these past determinants to predict future determinants of demand. Projecting the populations that will demand these medical services is a critical step in the forecasting process.

**Projecting Populations**

Specific populations are often defined by boundaries, such as geography and time, as well as other important characteristics such as eligibility. Population projections retain these geographic and characteristic boundaries, but look forward in time. In the classic modeling of demographics, the key components of projected population growth are **births**, **deaths**, and **migrations**. A population can grow or decline as a result of the number of births that take place, the number of deaths that occur, and/or by the number of people moving in or out of a geographic location. In the MHS, these components are slightly modified to account for characteristics that are unique to the military population. For example, MHS population projections must account for **new eligibility** (e.g., military accessions, marriage, Guard/Reserve activation) and the **loss of eligibility** (e.g., leaving active duty).

The projected population is calculated by appropriately adding and subtracting these key demographic components to the previous population. However, this calculation is greatly enhanced when components of specific subpopulations, such as age, gender, and beneficiary category, are also taken into account. Understanding how the key components of population change vary among different subpopulations provides planners with the type of information needed to plan for the population's diverse needs, as these characteristics often closely relate to the demand for different types of services. For example, a population composition that has a large percentage of children implies the need for primary health services. The distribution of women, especially in their early reproductive years, may imply the need for specialized health services for childbearing. The method of incorporating subpopulation-specific components of population change into population forecasts is known as the cohort-component method. This method requires complicated calculations that many individual analysts do not wish to attempt. Fortunately, the Managed Care Forecasting and Analysis System (MCFAS) incorporates these subpopulation calculations and addresses eligible population projections effectively. Though the MCFAS database tool was decommissioned in April 2011, eligible population projections are still available in the MCFAS file of the MHS Data Repository (MDR). Specifications for this file can be found at http://www.tricare.mil/ocfo/bea/mdr.cfm.

**Projecting Enrolled Populations**

Unlike eligible population growth, enrollment is a consumer choice that is subject to both supply and demand constraints. In an efficient market, price acts to equilibrate supply and demand. However, in the MHS, price is relatively fixed, and price and demand are not forced to equilibrium. In addition, supply may be determined by an arbitrary rule not reflective of actual demand (e.g. every PCM will be limited to 1,500 enrollees). As a result, inherent inefficiencies, such as excess capacity and unmet demand, impede actual enrollment, and enrollment projection models must take into account these supply and demand constraints.

At the MTF level, supply constraints occur when enrollment capacities for PCMs are exhausted. In this case, enrollment is a function of two components: the **number of PCMs** and the **capacity of each PCM for enrollees**. Future enrollment is estimated based on expected changes in either the number of PCMs or their individual enrollment capacity, or both, since it is future capacity that will determine future enrollment. When considering supply constraints, it is also important to factor **equivalent lives** into capacity and enrollment measures. Equivalent lives are a predetermined list of MHS-specific adjustment factors that are used to normalize each enrollee's expected relative resource utilization across age groups, gender, sponsor service, marital status and beneficiary category.

Demand constraints occur at the MTF level when additional enrollment capacity for PCMs exists. In this case, future enrollment is a function of **eligible population projections** and the **penetration rate** (i.e., the expected desired enrollments). The product of these two components produces the demand rate.

Currently, there is no readily available data source for pre-calculated MHS enrollment projections. Instead, analysts must use predictive modeling techniques that allow the input of five key components: the number of PCMs, PCM enrollment capacity in equivalent lives, the MCFAS expected populations, the expected desired enrollments (i.e., the penetration rate), and the expected enrollment case mix (equivalent lives per enrollee). Because there is a fair amount of uncertainty in the actual values of many of these key components of enrollment projections, analysts should also test the sensitivity of the outcome measure (future enrollment) to any variability in the key input estimates.

*Some content in this article was adapted from the "Forecasting and Risk" module of the Advanced WISDOM course.*

## DATA AND INFORMATION SYSTEMS
### *– POPULATION CONCEPTS IN MHS DATA*

There are many different population concepts available to users of MHS data and choosing the "right" concept for your question can sometimes be challenging. All the population concepts discussed in this section are available in all M2 tables, along with corresponding geographic attributes, such as name, region, Service, and command. The following population concepts will be discussed: Catchment Area; PRISM Area; MTF Service Area; and Multi-Service Market Area. A new "gold standard" Catchment Area directory will also be discussed.

Beneficiaries can only be assigned to the geographic area of one MTF. Beneficiaries who live near more than one MTF are allocated based on their sponsor service and distance to the MTF. Beneficiaries are assigned to the closest MTF of their own service unless there is an MTF more than 10 miles closer.

As of April 2011, there are 59 inpatient Catchment Areas and 287 PRISM Areas/MTF Service Areas. Of the 59 inpatient Catchment Areas, 20 surround Navy facilities. Among the 287 PRISM/MTF Service Areas, there are 113 Navy facilities.

**Catchment Area**

A Catchment Area is defined as the geographic area that represents roughly a 40-mile radius around a bedded inpatient facility. The beneficiary population of a Catchment Area is comprised of those eligibles residing within 40 miles of the MTF, or in the case of active duty military members, it is based on the distance from the MTF to the individual's duty location. Beneficiaries residing more than 40 miles from a bedded inpatient facility are assigned a Catchment Area DMIS ID of 09XX or 078X—these codes typically designate a state, part of a state, or county and are considered "non-Catchment". M2 users pulling data by Catchment Area will get results for the 59 inpatient Catchment Areas, as well as all of the existing "non-Catchment" Areas.

Although Catchment Areas are associated with individual branches of service, non-Catchment Areas do not discriminate in this way. When a quantification of the eligible population associated with a particular branch of service is desired, this is usually done by summing the population counts for the Catchment Areas associated with that branch of service and the portions of the population in the non-Catchment Areas that have a sponsor associated with that branch of service. For the Navy, this would be the population of eligibles for all Navy Catchment Areas plus the population of eligibles in non-Catchment Areas that have a sponsor associated with either the Navy or Marine Corps.

**PRISM Area**

A PRISM area is defined as the geographic area that represents roughly a 20-mile radius around a stand-alone MTF—both inpatient and ambulatory-only facilities. PRISM stands for Provider Requirement Integrated Specialty Model. When pulling data by PRISM area, users are most interested in what is going on closest to their MTF. All beneficiaries residing more than 20 miles from a PRISM area will be identified as living in a non-PRISM Area (with 09XX or 078X DMIS IDs). It should also be noted that the entirety of a PRISM area may exist totally within a Catchment Area, within a non-Catchment Area, or straddle the two.

**MTF Service Area**

An MTF service area is similar to both Catchment and PRISM areas. It is similar to Catchment Area, because the geographic radius used is 40 miles; but like a PRISM area, both inpatient and ambulatory MTFs are included. MTF Service Areas were introduced at the end of fiscal year 2005. This concept allows users to compare data at all sites using the same 40-mile radius around a facility.

**Difference between Catchment Area and MTF Service Area**

While conceptually similar, an MTF Service Area and a Catchment Area will not always represent the same area for inpatient MTFs. The reason for this is that when determining Catchment Areas, only inpatient facilities are considered. When determining MTF Service Areas, beneficiaries that live in overlapping MTF Service Areas are disbursed among both inpatient and ambulatory MTFs in the overlap based on sponsor service and distance to the MTF. For example, the Fort Stewart Catchment Area has roughly 90,000 beneficiaries assigned to it. However, the Fort Stewart MTF Service Area is much smaller, with only about 56,000 beneficiaries. This is because Fort Stewart is the only inpatient MTF in the area, so that the Catchment Area gets the entire population. But when the MTF service area concept is invoked, the two clinics surrounding Fort Stewart are considered when determining overlap areas, and consequently, a large portion of Fort Stewart's Catchment Area residents are actually residents of a different MTF Service Area.

**Multi-Service Market Area**

Multi-service market areas (MSMA) are areas that have overlapping Catchment Areas. The 13 MSMAs are: National Capital Area; Tidewater, VA; Bragg/Pope AFB, NC; Naval Hospital Charleston/Charleston AFB, NC; Ft. Jackson/Shaw AFB, SC; Mississippi Delta; San Antonio, TX; Colorado Springs, CO; San Diego, CA; Puget Sound, WA; Hawaii; Anchorage, AK; and Fairbanks, AK.

MSMAs are helpful in identifying larger areas where patients have many choices of MTFs, even across Service lines. Approximately 60 percent of beneficiaries that live in Navy Catchment Areas live in one that is part of a MSMA.

**Gold Standard Catchment Areas**

One limitation of all of the geographic concepts described above is that the distance from an MTF to a particular zip code has been historically defined based on the geographic center of the beneficiary zip code, instead of where the military population actually lives. In areas near large cities, the effect can be dramatic. Navy escapes the effect, for the most part; however, some MTFs are affected. For example, 2,500 beneficiaries assigned to the Pensacola Catchment Area are really thought to live closer to Eglin AFB than to Pensacola. The gold standard Catchment Area is assigned based on where the military population actually resides. The gold standard Catchment Area is available in the M2 MCFAS table only and is called "Catchment Area ID of record".

**Enrollment**

An important consideration when using geographical constructs to determine markets for MTF health care services is to note that the beneficiary's choice of enrollment location is not part of the calculation. Beneficiaries make choices about where to enroll, while the Catchment, PRISM and MTF Service Area allocations do not take that choice into consideration. When trying to determine which patients might utilize health care, it is best to assume that if a patient chose an enrollment location, the choice was made based on where the patient expects to seek care. Therefore, it is recommended that for enrolled populations, it should be assumed that the beneficiaries who enroll at an MTF are likely to receive care at that MTF. For non-enrolled populations, Catchment Areas and other similar geographic designations work well.

**Population Areas Used in the TRICARE Contracts**

MHS data files also contain some population concepts that are applicable to the management and operations of the TRICARE contracts. Prime Service Area (PSA) is a geographic area where TRICARE Prime benefits are offered. Regional contractors are required to establish a TRICARE Prime network in TRICARE PSAs. This includes all Catchment Areas, Base Realignment and Closure sites, MTF Service Areas, and all additional areas proposed by the regional contractors. A PSA flag is available in many M2 data tables indicating whether or not a beneficiary resides in a PSA. Market Area IDs are also available in many M2 data tables, and are defined and used by the TRICARE Regional Offices to manage local TRICARE efforts.

## NEW KNOWLEDGE

*– NOTED PUBLICATIONS*

Using Geographical Information Systems (GIS) to conduct spatial analysis can enhance the understanding of complex data sets and populations. GIS can be used to answer questions about a population's health-related needs, risks, and access. A recently published article is noted below because it reviews GIS practices in the context of informing analysts and decision-makers about specific health-related issues.

**Geographic information systems (GIS) for health promotion and public health: a review**

Nykiforuk CIJ, Flaman LM.
*Health Promot Pract.* 2011 Jun;12(1):63.

This is a literature review of 621 articles dealing with GIS and health. The authors discuss the benefits of using GIS to analyze data to answer complex questions in health promotion, public health, community medicine, epidemiology and many other fields. The authors group the articles into four main, overlapping categories: disease surveillance, risk analysis, health access and planning, and community health profiling. The most common of these is disease surveillance, which is the collection of data on the incidence, prevalence, or spread of disease. Risk analysis is the assessment and communication of risk, relative to impacts on health. This type of analysis is usually linked with environmental health, such as air pollution and the prevalence of asthma. Health access and planning describes a population's ability to use health services when needed. A common example of this is a mapping of drive times to the nearest hospital or emergency department. Community health profiling is the mapping of information regarding the health of a population in a community. Read more about this publication at http://www.ncbi.nlm.nih.gov/pubmed/19546198?dopt=Abstract.

## TIPS AND TRICKS:

*– DIRECT ADJUSTMENT*

One of the most common tasks faced by analyst is the comparison of some statistic between multiple populations. This task can take many forms: PMPM costs over time, hospitalization rates across multiple facilities, or clinical measures across different types of beneficiaries, to name a few. In any of these comparisons, the underlying demographics of the populations of interest can drive differences that may distract from the primary aim of the analysis. For the remainder of the discussion, we will assume that age and gender differences are the distributional effect to be removed, though in practice, this could be any number of attributes.

There are several tools available to account for population differences. The simplest approach is to simply examine the rate within each age/gender group (these are

known as the stratum-specific rates). For some comparisons, this step alone may be enough to identify whether the age/gender distribution is distorting the analysis. On the more complex end of the spectrum, multivariate statistical analysis can be conducted to isolate the effect of particular independent variables. However, this approach is often more analytical firepower than is required. In between these two extremes is direct adjustment, where a standard population distribution is applied to the stratum-specific rates to calculate a weighted average for each of the comparison groups.

The first step in direct adjustment is the calculation of the stratum-specific rates. In the example where we are adjusting for age/gender mix, the rates should be calculated for each age/gender group for all comparison populations that comprise the analysis.

After determining the stratum-specific rates, a standard population distribution must be developed. For a given analysis, there may be several reasonable options for use as a standard population. The standard population should be broadly defined enough such that all of the comparison groups of interest are covered within the standard population. For example, when comparing types of beneficiaries enrolled to a single facility, the age/gender distribution for that facility would be appropriate. However, when comparing a metric across multiple facilities, the standard population should encompass at a minimum all facilities covered by the comparison, possibly even using all MTF enrollees as a standard population. Within this general guideline, the standard population will typically be determined based on the available data and the analyst's judgment. Whatever standard population is selected, this should be reported in the documentation of any resulting analysis.

The final step in direct adjustment is the calculation of the adjusted rates. To do this, the standard population distribution is applied to the stratum-specific rates for each individual comparison population to obtain a weighted average. The resulting total weighted average is the directly-adjusted rate for each comparison group. These directly-adjusted rates can then be compared so that conclusions can be made concerning the measure without any distortion from differences in the age/gender distribution of the comparison groups. It is important to understand that the directly-adjusted rate is useful only for comparisons to other rates "standardized" to the same standard population distribution and does not have any 'real world' interpretation beyond this comparison.

One additional caution around the use of directly-adjusted rates is that such adjustment is not associated with statistical significance. A small difference in directly-adjusted rates is no more or less likely to be statistically significant than a small difference in unadjusted rates.

At times, direct adjustment may not be possible because data are either unavailable or insufficient to calculate stratum-specific rates. In this instance, indirect adjustment may be desirable, where standard stratum-specific rates are applied to the individual distributions. However, direct adjustment is almost always preferable when adequate data are available.

| Gender/Age Stratum | Number of Events (a) | Population (b) | Stratum-Specific Rate per 100,000 (c=(a/b)X100,000) | Standard Population Distribution (d) | Adjusted Rate (cXd) |
|---|---|---|---|---|---|
| Female 0-17 | 579 | 12,951 | 4,471 | 15.4% | 687 |
| Female 18-34 | 815 | 14,230 | 5,728 | 17.7% | 1014 |
| Female 35-44 | 407 | 5,603 | 7,263 | 6.8% | 491 |
| Female 45-64 | 359 | 9,305 | 3,858 | 8.4% | 322 |
| Male 0-17 | 640 | 13,854 | 4,620 | 16.1% | 746 |
| Male 18-34 | 748 | 16,083 | 4,651 | 19.2% | 895 |
| Male 35-44 | 369 | 6,617 | 5,577 | 7.4% | 415 |
| Male 45-64 | 356 | 9,905 | 3,594 | 9.0% | 323 |
| **Total** | **4,273** | **88,548** | **4,826** | | **4,893** |

The crude (unadjusted) rate is 4,826 events per 100,000 population. The age/gender-adjusted rate is 4,893 events per 100,000 population.

## WHAT'S COMING UP?

Changes are coming in geographic designations associated with the newest round of TRICARE contracts. Health care delivery began under the North contract on 1 April, and with that, new Prime Service Areas took effect. The M2 "Prime Service Area Flag" and the M2 "Market Area ID" will be updated accordingly. As the other contracts roll out, their Prime Service Area values will also change. Finally, the Fort Campbell area will move from Region South to Region North once the South contract is awarded.

## KNOWLEDGE SOURCES

*– RECOMMENDED SERIALS*

Analytics is ultimately applied to evaluate and effect change within our healthcare system. The following journal is recommended reading for those who wish to broaden their capabilities by acquiring a foundational understanding of current topics and issues in health services research and policy, and influencing the design of some component element.

***Health Affairs***

*Health Affairs* is the leading peer-reviewed journal of health policy thought and research. Health Affairs is a multidisciplinary journal covering a wide range of health issues. Topics covered include: access to care, health spending, quality, Medicare, Medicaid, prescription drug coverage and costs, physician practice, nursing trends, mental health, malpractice and health law, insurance reform, hospitals, global health, and disparities in health care, and more.

*Health Affairs* is published monthly. Online peer-reviewed papers of a timely nature are published weekly, on average, as Web First papers and are then included in the next available print issue. Every article Health Affairs has ever published is available online at www.healthaffairs.org. Subscribers have access to all journal content. However, all readers have free access to all journal articles three years old or older, as well as free access to Web First papers during the first two weeks of posting and free access to all Health Affairs Blog content.

## IN THE NEXT ISSUE...

The next issue of *Healthcare Analytics in Navy Medicine* will focus on identifying and quantifying obstetrical care delivered by Navy Medicine to its beneficiaries. Understanding the changing obstetrical health needs, as well as quality of care and access challenges, for the Navy's pregnant population is essential to accurate planning and budgeting for obstetrical care and services. The next issue will highlight current policy and practice issues related to obstetrical care and feature skills and tools available to analysts to address these issues.

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